

THINGS THAT SCIENTISTS SHOULD UNDERSTAND ABOUT NASA SPACEFLIGHT RESEARCH

Steven H. Platts, Ph.D., NASA JSC
Terri Bauer, SGT, Inc
Shanna Rogers, KBR/Wyle



So you want to conduct human spaceflight research aboard the International Space Station (ISS).....

Challenges in Conducting Human Flight Research

- Crew time: preflight, inflight and postflight
- Conflicts and constraints with competing research
- Sample storage and stability
- Experiment complexity
- Power requirements
- Data and communications availability
- Hardware access/failures
- Restricted flight ops
- Weight and volume
- Astronauts may be presented with over 30 human research experiments and select, on average ~15 in which to participate.

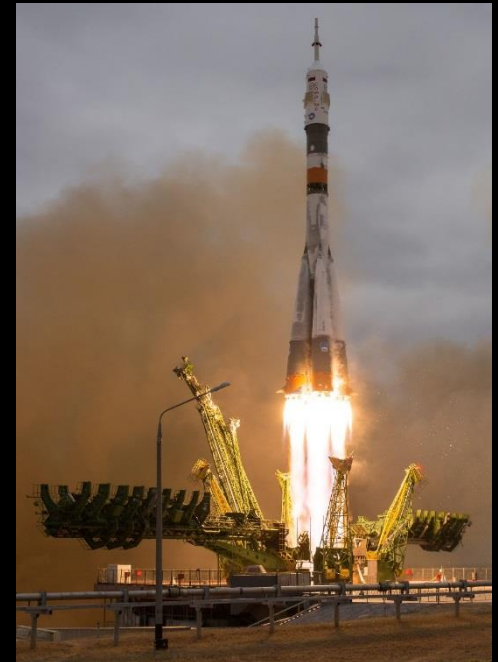




“ I’ve been selected for a flight study, now what”?

- ISSMP is here to help HRP-sponsored investigators!
- Requires adequate time to plan and integrate with other research on ISS
- Requires investigators to be flexible and sensitive to the unique constraints of spaceflight.

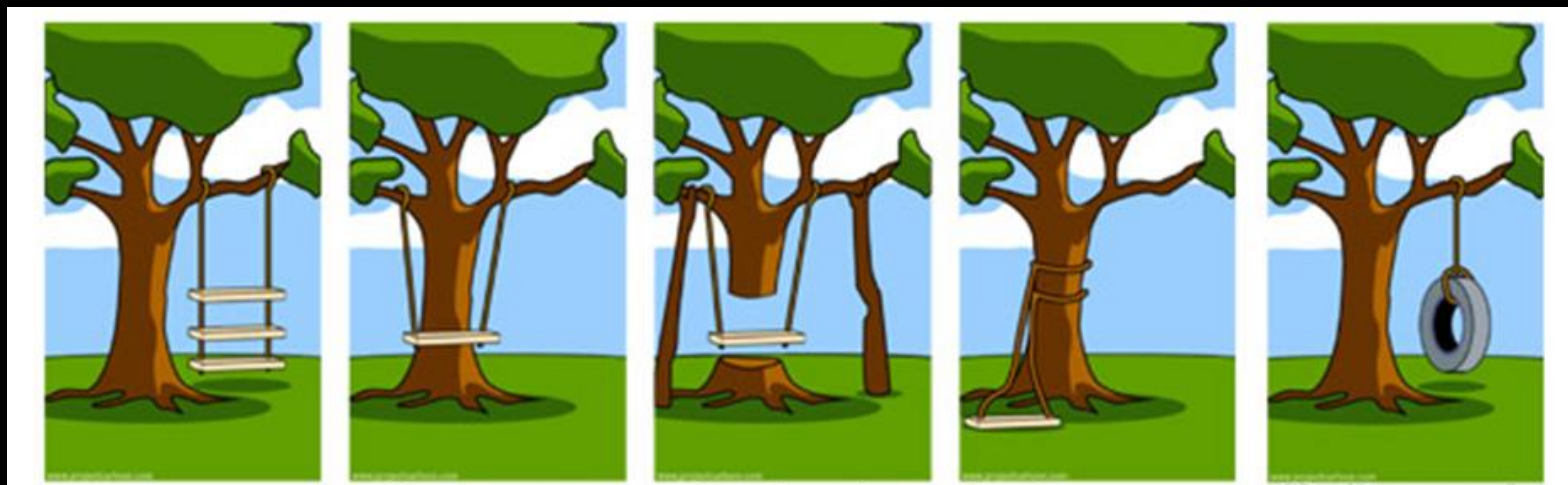
Once your spaceflight research aboard the ISS proposal is “Selected for Flight”
the real work begins.





Requirements

- The most important thing for investigators to convey to the ISSMP team is their **RESEARCH REQUIREMENTS**.
- Requirements are captured in the Experiment Document. This document is the official record of how, what, where and when data will be collected.
- If a research requirement is not in this document....it will not get done.
- Performance and success of the research is directly related to the science requirements.



How the PI described
experiment

How the project
manager understood
experiment

How the experiment
document was
written

How the
procedures were
written

What the PI really
needed



“ How do I document my requirements” ?

➤ The Experiment Document

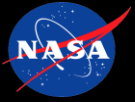
- Provides the vehicle for Principal Investigators to formally specify the requirements for performing their experiments.
- Establishes and controls requirements for experiment activities
- Defines selection and training of flight crew members
- integration and ground processing of flight experiment equipment
- Describes the collection, processing, and archiving of experiment data.

It is the primary source of experiment specifications for the ISSMP to implement the research.

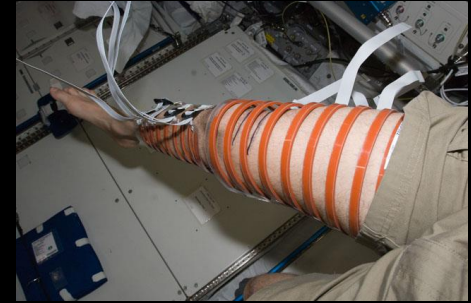


Sample Experiment Document Page

Session ID		Session Title					Assoc. Exp. Session	
Scheduled Days (L- and/or R+)				Session Time (min)		Crew Time Usage (min)		Location (s)
Session Scenario								
No.	Session Flow					Session Time (min)		
1								
2								
3								
4								
Scheduling Constraints								
Session Constraints								
1.								
Session Unique Information								
Hardware/Software Required			Qty.	Provided by		Comments		
Sample Name			Units	Sample Volume/Accuracy		Urine Aliquot Type	Comments	
						24-hr pool Void by Void Single Void N/A		
Facility Requirements						Timeframe for Facility Access		
						N/A		
Environmental Parameter Name			Units	Monitored and/or Controlled		Range	Recording Method	
Risk Level				Medical Monitoring Level				



Requirements



➤ This is NOT a requirement:

- “It would be nice to have as many of our data collections as early in flight as possible.”

➤ This IS a requirement:

- “First data collection must occur on flight day 45 +/- 3 days.”

Elegance and complexity may get a higher merit score, but are not your friend in space





What happens if you do not define your requirements well.....





Things to Know !

- All Human Spaceflight research is voluntary. Crew members are presented the full cadre of research studies (USOS) and select those in which they are willing to participate via an Informed Consent Briefing.
- The research requirements are then integrated to form a complement of research for each astronaut based on his/her selections and other factors (crew time available, compatibility, etc).
- What do we mean by integration?
 - Many experiments have overlapping requirements; blood draws, behavioral surveys, heart rate measurement.
- Where possible, these measures are combined to reduce redundancy and save crew time.
- Investigators can access these data via data sharing agreements and the Data Sharing Plan.





Additional Limitations

- Large/heavy hardware, invasive procedures, and toxic reagents are extremely difficult to implement on the ISS.
 - No MRI on station, ever...but we have ultrasound
 - Toxic substances highly restricted (definition of toxic set by NASA)
 - Flammable substances restricted
 - Invasive procedures like biopsy (in flight) unlikely to happen
- There are strict limits placed on the amount of blood that can be drawn from crew members during spaceflight.
- These limits are based on 30-day rolling accumulations (150 ml, 100ml last 30 days).
- We have recently started restricting studies due to this limit.





Additional Limitations II

- Caffeine use
 - issue for preflight, inflight and postflight
- Medication use
 - Sleep, nausea, headache, stuffiness, etc
 - Documentation sufficient or restriction
- Too many data acquisition sessions/too much time per session
- Timing of sessions:
 - many experiments request the same days for data collection
 - docking operations and EVA greatly alter crew availability
- Compliance!!!



QUESTIONS